

***Environmental Management System
Implementation Study of UTC Facilities
Final Report of Survey Results***

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Contract Number: 68-W-99-020
EPA Work Assignment Manager: Gina Snyder
Telephone Number: (617) 918-1837
Prepared by: Tetra Tech EM Inc.
Tetra Tech Work Assignment Manager: Sue Patterson

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ACRONYMS AND ABBREVIATIONS

BMP	Best management practices
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMA	Chemical Manufacturers Association
CWA	Clean Water Act
EH&S	Environmental health and safety
EMS	Environmental management system
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
LDR	Land Disposal Restrictions
MSIP	Management Systems Improvement Plan
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NO _x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and maintenance
P&W	Pratt and Whitney
P2	Pollution prevention
RCRA	Resource Conservation and Recovery Act
SPCC	Spill prevention, control, and countermeasures
Tetra Tech	Tetra Tech EM Inc.
UST	Underground storage tank
UTC	United Technologies Corporation
UTRC	United Technologies Research Center
VOC	Volatile organic compounds

DISCLAIMER

The information included in this document is a summary of the EPA/UTC Environmental Management System Implementation Study including survey responses and ideas that may help address environmental compliance issues identified in the survey responses. This document is intended solely to assist environmental managers, regulators, and other interested parties to better understand the causes of noncompliance and to consider recommendations and ideas that may help improve environmental compliance and performance. It should be emphasized that EPA has neither reached any conclusions nor made any decisions in response to the conclusions, recommendations, or ideas presented. This document is not a substitute for complying with the regulations themselves. Neither UTC nor EPA makes any guarantees nor assumes any liability with respect to use of any information, recommendations, conclusions or ideas contained in this document.

ABSTRACT

This Environmental Management System (EMS) Implementation Study (study) has been prepared by U.S. Environmental Protection Agency (EPA) - New England (Region 1), with assistance from its contractor, Tetra Tech EM Inc., in conjunction with representatives of United Technologies Corporation (UTC). This study builds upon the work performed under a similar project previously conducted by EPA and the Chemical Manufacturers Association (CMA) (the EPA/CMA Root Cause Analysis Pilot Project or RCA project). This study is designed to (1) determine the effect that implementation of an EMS has on compliance, (2) identify or evaluate differences in root causes of noncompliance before and after implementation of an EMS at a facility, and (3) identify or evaluate differences in pollution prevention (P2) practices before and after implementation of an EMS.

Between 1988 and 1990, EPA conducted inspections and file reviews of UTC facilities in New England to determine these facilities' compliance with requirements under the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act (CWA). Based on the results of these inspections, EPA and UTC entered into a consent decree that required UTC to, among other things, (1) develop EMS for its facilities, and (2) conduct third-party audits to determine compliance at its facilities after the EMSs had been implemented.

EPA developed compliance profiles and surveys to meet the goals of this study. Based upon the information contained in the profiles and surveys, some of the conclusions are:

- Compliance at UTC facilities improved from the time the initial EPA inspections were conducted until the time the third-party audits were conducted. This assertion is based on (1) fewer total instances of noncompliance at individual facilities, and (2) less severe violations being identified in the third-party audits.
- The root cause of noncompliance generally shifted after implementation of EMSs at UTC facilities. The most common root causes of noncompliance before implementation of EMSs at UTC facilities were related to a lack of management controls to ensure compliance. After EMS implementation, the most common root cause of noncompliance was regulations and permits followed closely by human error and failure of individuals to comply with established policies and procedures.
- P2 activities typically were more sophisticated after implementation of EMSs at UTC facilities. UTC also had more systems in place to measure performance of P2 activities after EMSs were implemented.
- There were many similarities between the findings of the post-EMS portion of this study and the RCA project, supporting a number of recommendations of the RCA project.

EXECUTIVE SUMMARY

In the United States, despite growing interest in environmental management systems (EMS) and standards, some companies and regulatory agencies are uncertain about the benefits of developing an EMS. The U.S. Environmental Protection Agency (EPA) is interested in the benefits that implementation of an EMS might have in improving compliance with environmental regulations, as well as the benefits such implementation might have on pollution prevention. EPA - New England (Region 1), in conjunction with United Technologies Corporation (UTC), used the methodology developed by EPA's Chemical Industry Branch and the Chemical Manufacturers Association (CMA) in the Root Cause Analysis Pilot Project (the EPA/CMA Root Cause Analysis Pilot Project [EPA-305-R-99-301], herein referred to as the RCA project) to explore the effect of implementation of an EMS on compliance and pollution prevention. One of the goals of the project was to determine whether regulatory compliance improves as a result of implementation of an EMS. The survey used in the RCA project was modified to analyze the effect of implementing EMSs on compliance and pollution prevention at eight of UTC's facilities in New England.

The UTC project surveys were designed to obtain information to:

- Determine the effect that implementation of an EMS has on compliance
- Identify or evaluate differences in root causes of noncompliance before and after implementation of an EMS at a facility
- Identify or evaluate differences in pollution prevention (P2) practices before and after implementation of an EMS at a facility

From 1988 to 1990, the eight participating UTC facilities were subject to EPA inspections and records reviews under the authority of the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act (CWA). As a result of issues of noncompliance identified during those inspections and records reviews, a consent decree was filed in the United States District Court for the District of Connecticut in 1993. The consent decree required UTC to perform a management systems analysis, develop and implement management systems improvement plans, and subsequently perform compliance audits. The follow-up audits, completed in 1998 by a third party, evaluated compliance with regulations under all applicable environmental statutes at all of UTC's facilities in New England. Despite the differences in scope of the two sets of compliance evaluations (pre- and post-EMS implementation), EPA and UTC had a rare opportunity to compare the compliance status of UTC facilities before and after implementation of an EMS.

This report summarizes the findings of that comparison by examining the compliance rates before and after implementation of an EMS and the changes in root (or underlying) causes and contributing causes of the noncompliance.

Types of Noncompliance

The types of noncompliance varied considerably between 1990 and 1998. In 1990, the most common types of noncompliance included (1) effluent violations and unauthorized discharges in violation of requirements under the CWA, and (2) failure to label and mark containers holding hazardous waste and prepare land disposal restrictions documentation, as required under RCRA. In 1998, the most common types of violations included violations of various stormwater regulations under the CWA and inadequacies found in self-inspections and contingency plan documentation required under RCRA.

Overall, the number of instances of noncompliance dropped substantially from 1990 to 1998. In addition, the 1998 instances of noncompliance tended to be more minor in nature than the 1990 violations.

Root Causes

UTC facilities were asked to identify the root causes of noncompliance from a list of 12 categories of root causes developed for this project. UTC was requested to identify a maximum of three root causes that applied to each instance of noncompliance. The general categories of root causes of noncompliance identified most frequently in the pre-EMS surveys included management (most often, specifically “*no formal management structure to address noncompliance and follow-through*”), procedures (most often, specifically “*no written operating procedures available*”), and human error (most often, specifically “*individual responsibility and professional judgment*”).

The general categories of root causes of noncompliance identified most frequently in the post-EMS surveys were the same categories identified in the RCA project and included regulations and permits (most often, specifically “*facility unaware of applicability of a regulation*”), procedures (most often, specifically “*operating procedure not followed*”), and human error (most often, specifically “*individual responsibility or professional judgment*”).

Contributing Causes

UTC personnel were free to identify as many contributing causes as were applicable to specific instances of noncompliance in both the pre- and the post-EMS surveys. The most frequently cited contributing causes of noncompliance in the pre-EMS surveys were policies, compliance monitoring, and management; in the post-EMS surveys, the most frequently cited contributing causes of noncompliance were procedures, human error, and compliance monitoring.

Pollution Prevention

Results of the survey indicate that, although UTC had begun implementing P2 activities in 1988, most of those activities were undertaken in response to environmental reporting requirements (for example, requirements for reporting releases to the Toxic Release Inventory).

Unfortunately, P2 efforts before 1992 were not documented at the individual facility level; therefore, data do not exist to evaluate links between the evolution of early P2 programs and implementation of an EMS at UTC facilities. However, the information that is available suggests that UTC has implemented many successful pollution prevention programs from the time of the 1990 inspections until the evaluation of P2 practices in 1998.

In follow-up discussions with EPA, environmental personnel of UTC indicated that they believe that many of the management systems that were adopted to ensure compliance — especially the elements of accountability, management review, and setting of goals, objectives, and targets — have led to improvements in P2.

EMSs and Compliance

Analysis of the survey responses indicate that there is a strong relationship between the implementation of the EMS and improvements in compliance. In general, the nature of noncompliance changed from noncompliance with broad program-wide elements of the regulatory programs before implementation of an EMS to more localized noncompliance with individual regulatory requirements after implementation of an EMS. For example, while some UTC facilities were not performing weekly inspections of hazardous waste container storage areas in 1990, by 1998, it appeared that such inspection requirements generally were being met, although occasionally specific obligations related to those self-inspections (for example, documentation of such inspections for certain weeks) were not being fulfilled. Likewise, the root causes of noncompliance changed from lack of management systems (that is, no procedures were in place) before implementation of an EMS to deficiencies in individual elements within the systems (that is, the procedure was not followed or required updating) after implementation.

Comparisons to the RCA Project

The survey results were generally consistent with those of the RCA project. In particular, the post-EMS survey results mirrored the RCA findings: the same four categories of noncompliance were observed most frequently, the same three categories of root cause predominated in the same order, and two of the three leading contributing causes were the same.

These findings suggest that in organizations that have implemented EMS (such as UTC in 1998 and CMA members covered by the RCA project), improvements in compliance are most likely to come from a combination of (1) improving and maintaining the EMS, (2) training and other

means of increasing awareness of EMS compliance elements, and (3) clearer rules and more compliance assistance.

As was recommended in the RCA project, improvements in compliance might also result from the development of a better understanding of the causes of human error and the identification of actions to address the human error root cause category for those noncompliance categories for which human error was frequently cited.

Conclusions

- The primary root cause of noncompliance identified in the pre-EMS surveys was the lack of a formal management structure for addressing regulatory compliance issues. Representatives of UTC who completed the surveys indicated that the primary root cause of noncompliance in the post-EMS period was individuals not following established procedures, differences in interpretations of regulations by UTC facilities and regulatory agencies, or facilities being unaware of the applicability of new regulations.
- Regulatory compliance improved at the UTC facilities that responded with respect to RCRA and CWA noncompliance identified in the 1993 complaint filed against UTC and its facilities. This conclusion is supported by: (1) comparatively few repeat instances of noncompliance occurred in the 1998 audits and (2), on average, the fewer instances of noncompliance at facilities in 1998.
- The severity of noncompliance also typically decreased. For example, in 1990, two-thirds of the facilities had been cited for storing hazardous waste for more than 90 days, and five of the six facilities reviewed under the CWA had been cited for unauthorized discharges to surface water without permits. In contrast, the post-EMS surveys indicate that only one UTC facility had an unauthorized or unpermitted activity (a pretreatment discharge).
- Overall, the usefulness of information about practices at facilities (for example, elements of an EMS present) and responses to noncompliance events related to violations identified in the 1993 complaint may be limited because fewer individuals at UTC have first-hand knowledge of practices in 1990. For example, responses in the pre-EMS surveys that are related to corrective actions are the same for several facilities, because it is only known in general how violations were addressed, (that is, by implementing the EMS), but current personnel of UTC have only vague recollection of specific corrective actions in 1990.
- The general category of root cause of noncompliance identified most frequently in the post-EMS surveys was **Regulations and Permits**. Further evaluation of the specific root causes reveals that disagreement over the interpretation of regulations often is cited as the root cause of noncompliance. UTC recommended UTC and the regulatory agencies should strive to improve communication (for example, through meetings or other

communication in addition to such activities as formal inspections) because a stronger establishment of informal dialogue may build greater understanding of facility operations on the part of regulators and greater understanding of the regulators' interpretations of regulations on the part of UTC.

- On the basis of responses to the post-EMS survey, UTC should review its programs for effectiveness on employees to maintain compliance. **Human Error** and **Communication** became more prominent as root causes of noncompliance (accounting for a greater percentage of instances of noncompliance) in the post-EMS profiles, compared with the pre-EMS profiles. Modification of training programs may be a logical step in addressing those root causes of noncompliance.
- Implementing an EMS appears to have moved the root causes of noncompliance from the category of management (lack of structure, control and oversight, guidance) toward the more intractable root causes of human error and communication.
- UTC should review its process for the evaluation and implementation of procedures for complying with new regulations. Many of the instances of noncompliance identified in the post-EMS profiles were related to regulations issued by EPA or the state during the period between 1990 and 1998 (for example, stormwater regulations under the CWA). Although the post-EMS surveys generally indicate that specific personnel are assigned to monitor new regulations, the results of the 1998 audits indicate that such monitoring may not have been sufficient to ensure compliance in all cases.
- **External Circumstances** played a more prominent role as a root cause of noncompliance in the post-EMS surveys than in the pre-EMS surveys. This provides an example of how more intractable root causes may become more prevalent after EMSs have been implemented. Several of the facilities do not include communication with external entities in their EMSs. Thus the root cause of **External Circumstances** could potentially be addressed by greater involvement with external entities (for example, suppliers, customers, contractors, and vendors) under the EMS in place at each facility.
- The results of both UTC and RCA projects support EPA and state agencies continued work on issuing straightforward, plain language regulations, and continued coordination within their organization and with each other to ensure clear and consistent interpretation of those regulations. The results also support continued or increased compliance assistance activities, particularly with respect to new regulations and important new interpretations.
- It appears that the implementation of EMSs may offer the advantage of helping a facility to focus on environmental compliance issues. This statement is based on improved compliance rates at participating UTC facilities, including both (1) fewer total instances of noncompliance at each facility, and (2) fewer facilities with individual instances of

noncompliance. In addition, instances of noncompliance identified during the 1998 audits typically were much less severe than those identified during the 1990 inspections.

- Results of the survey indicate that, although UTC had begun implementing P2 activities in 1988, most of those activities were undertaken in response to environmental reporting requirements (for example, requirements for reporting releases to the Toxic Release Inventory). P2 efforts at UTC have increased markedly since 1990, aided by the increased emphasis on reporting and accountability inherent in EMS.
- The findings of this analysis suggest that in organizations that have implemented EMS (such as UTC in 1998 and CMA members covered by the RCA project), improvements in compliance are most likely to come from a combination of (1) improving and maintaining the EMS, (2) training and other means of increasing awareness of EMS elements and regulatory requirements, and (3) clearer regulations and more compliance assistance.
- As was recommended in the RCA project, this study indicates that improvements in compliance might also result from the development of a better understanding of the causes of human error and the identification of actions to address the human error root cause category for those noncompliance categories for which human error was frequently cited.